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A JOURNEY IN THE LIBYAN DESERT

BY

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It is probable that some portions of the depressed areas in the Libyan desert have been the scenes of human activity and habitation from very remote periods, and although existence there must always have been arduous and precarious, the human pressure in the more habitable but circumscribed regions of the Nile Valley and Delta would tend to force the weaker people thereto.

This generalization, however, perhaps expresses but one half of the incentive which forces human beings into such inhospitable regions, for it is also evident that the man of exceptional enterprise and vigor, finding his opportunities becoming few and inadequate in locations such as the Nile Valley, where every pint of available water and every foot of available land is already performing its appointed part in the sustenance of life, will also be attracted by the desert, with its vast expanses and indefinite but ever possible opportunities for exploration and adventure. Of all the arid regions in the world, the Libyan desert is one of the most inhospitable, and were it not for the few depressed areas which are rather loosely termed "oases," it would still exist as an absolute, instead of only a partial *terra incognita.*

In the course of the general study of desert conditions and of the capacity of arid regions to support life, which has been undertaken by the Desert Laboratory of the Carnegie Institution of Washington, it has become obvious that little has been done so far in making adequate scientific comparison between the more important desert areas. The need for such comparison was the incentive which led to the organization of an expedition in the winter of 1911-1912, consisting of Dr. D. T. MacDougal, the Director of the Department of Botanical Research of the Institution, together with the writer, which had for its object the examination of that portion of the Lybian desert

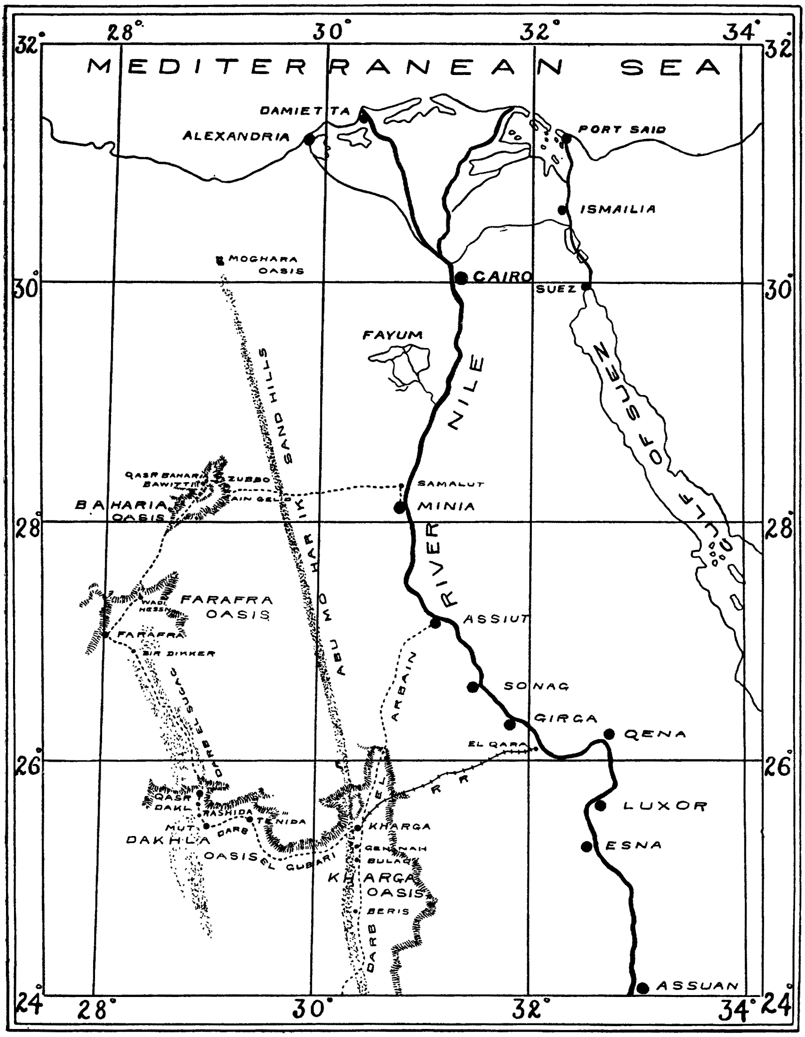

FIG. 1—Outline Map of Egypt showing position of the "inner oases" of the Libyan desert. Compiled from official maps and personal notes by Godfrey Sykes.

situated between the 25° and 29° N. Lat., and extending as far West as the 28th meridian. This area contains the main Eastern Oases: Kharga, Dakhla, Farafra and Baharia, and it was hoped that the examination of these several oases, and of the caravan routes connecting them with the Nile and with each other, would afford a sufficiently comprehensive idea of the topography and general conditions of the region.

The authentic history of the Libyan Oases can be traced back as far as the XVIIIth Dynasty (1545-1350 B. C.), but is fragmentary until the Roman period, when extensive engineering works, planned for the development and conservation of the water supply, were carried out by these energetic colonizers. After the Mohammedan conquest and conversion of Egypt, there seems to have been a general neglect of all the oases, and a failure on the part of either the dwellers therein or of the rulers of the country to keep in repair or further develop the various works which the Roman conquerors had so well begun.

At all periods the remoteness and inaccessibility of these habitable areas seems to have been responsible for their use as places of banishment for political, and other offenders.

A stele discovered at Luxor, and described by Brugsch, has indicated that this had been the custom long anterior to the time of 1033 B. C.

Juvenal, the poet, and Bishop Nestorius, were both prisoners in the Great Oases, and even under the present régime a detention settlement is maintained a few miles north of Kharga, in which undesirables are forced to reside. During the Middle Ages, geographical knowledge of the Libyan desert seems to have been both scanty and faulty, and the map of Castaldi, here reproduced, will serve to illustrate the local knowledge of the cartographer of the sixteenth century. Authentic modern knowledge of the region only dates back to Cailliaud, Edmonstone, and Hoskins, who all visited it early in the Nineteenth Century, and has been added to since by Rohlfs, Schweinfurth, Lyons and others.

The Egyptian Government has also made accurate but, unfortunately, very incomplete surveys of the several oases and of some of the caravan routes, the work having been done by Ball, Beadnell and others, and the results have been embodied in various government reports, but as the work had perforce to be done somewhat hurriedly and was confined in the main to meander-surveys along the caravan routes, with some plane-table work in the vicinity of the different villages, the maps of the region are still far from being satisfactory, and the difficulties of travel are such that it will probably be many years before our knowledge of the country is at all complete.

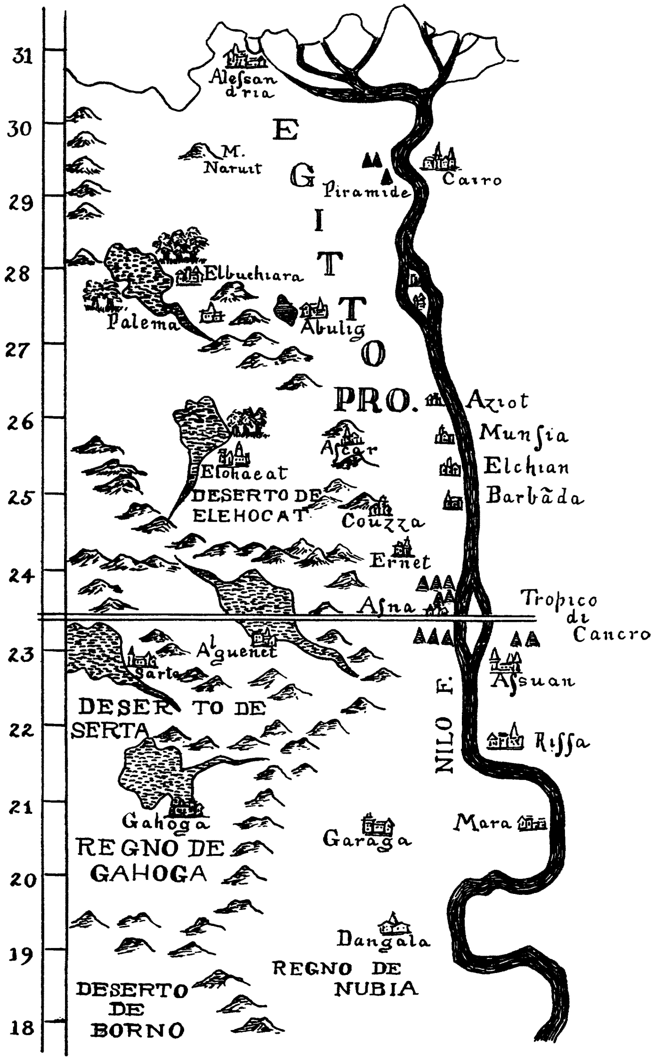

FIG. 2—Copy of a map of 1561 in the British Museum showing the oases of the Libyan desert. (Giacomo di Casteldi Piedmontese cosmografico in Venetia. Brit. Museum, K–44, 1561.)

The earliest inhabitants of the oasis areas no doubt obtained sufficient water from springs and natural outflows, but even admitting the existence of the lake, which Beadnell believes to have still covered the lowest part of the Kharga depression during the early period of human occupation, the available supply of water would never have proved adequate for any extended settlement, without artificial development, and it is probable that even in early Egyptian times, and certain that during the Roman occupation, artesian wells were dug or bored, and the natural supply largely augmented.

Some of the older wells which are in use to-day, no doubt date back to the Roman period, and extensive tunnels and subterranean aqueducts still exist in the different oases, and are in many places still carrying water, which are also the work of the Roman engineers.

There are evidences in many parts of the several oases, of former springs, wells and cultivated areas, now covered by drift sand or dunes. This, of course, expresses but one side of the equation of possible climatic change, inasmuch as many of the fields and groves cultivated by the present inhabitants were no doubt undeveloped in ancient times.

The most cursory examination of the wells will, however, reveal the fact that the static pressure of the underground water has in general become less, and this is no doubt largely due to the haphazard and unscientific way in which bores have been located, without any reference to the mutual interference of wells.

The inhabitants of the villages are, as a rule, singularly apathetic and unenterprising as regards water exploration and development, and Ball instances a case in his report on the Kharga Oasis (p. 57)* in which the men of the village of Dakhakin were with difficulty induced to accompany the Survey party a few kilometers into the sand hills, where abundant water of good quality was found in several places.

This same lack of enterprise or energy is also shown by the way in which wells and cultivated areas are often allowed to drop out of use owing to a slight fall in the water level, which would seem to suggest the installation of a shaduf or saquia in order to place the water upon the land.

The use of these mechanical water-raising devices would also serve another useful purpose, in making possible the cultivation of the higher land, which is usually less impregnated with salt than the lower areas, to which cultivation has gradually been restricted owing to the steady decrease of water pressure in the wells.

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* Kharga Oasis: Its Topography and Geology. By John Ball. 116 pp. Maps, plans, ills. *Geol. Surv. Report*, Part II, Cairo, 1900.

The unit of volume used in the estimation and measurement of the flow of water from wells and springs, is the *qirat*. Official water measurement is carried out by local officials for taxing purposes, but the system in vogue is so faulty and inexact that the *qirat* may mean anything between 125 and 250 litres flow per minute, with a general over-estimation in the case of the smaller wells and under-estimation with the larger ones.

The water of both wells and springs is generally potable and fair in quality, but is occasionally rather strongly impregnated with iron and other minerals, and in some localities, as, for instance, in the northern part of the Dakhla Oasis, it issues at quite high temperature, one well which we tested in the town of Qasr Dakhl registering 37°C.

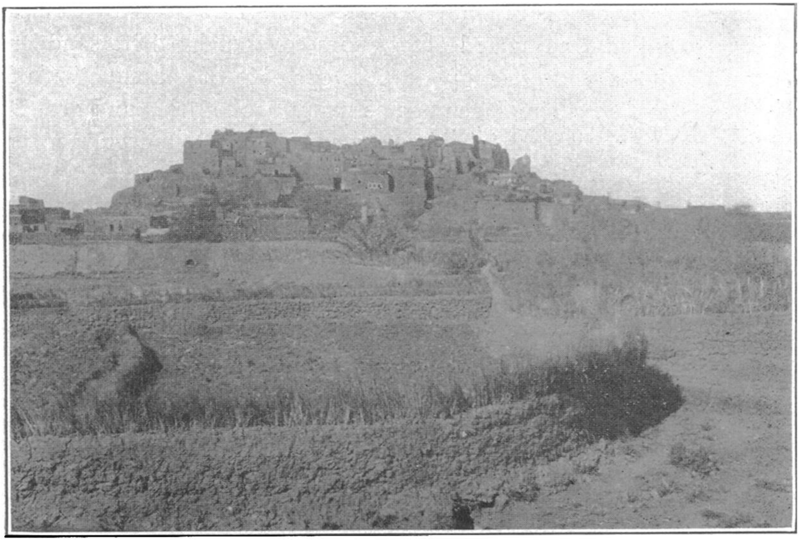

Fig. 3—The Village of Müt.

Paucity of water supply and encroachment of drifting sand are ever present problems for the dweller in the oases, and in addition to the upkeep of his wells, conduits, and ditches, he has been obliged at all times to undertake the construction and maintenance of walls, hedges, and barriers of various kinds, in order to preserve his precious fields and groves from destruction. The movement and behavior of drifting sand is one of the most pertinent problems in desert investigation, and the Libyan desert affords many striking examples of sand distribution.

The drifting sand throughout the region assumes in general the form of long ribbons or windrows of sand, with a general direction of N.N.W. to S.S.E. which coincides with the prevailing wind. Sometimes these ribbons have become broken up into lines of detached dunes, of characteristic crescentic form, but they are in general continuous, and often persist for scores, or, in some cases, for even hundreds of miles, with sharply demarked edges, and serrated crests. A peculiar feature of many of these sand belts is their arrangement in parallel lines only a short distance apart, thus leaving a sand-free strip of ground between them. Such a lane is termed by the Arabs "Sugag" or "passage," and is taken advantage of as much as possible in traversing sandy areas.

Of the desert surfaces in general in the Libyan region, the one which comes next to the sand in evil repute is that known as the Kharafish. This consists of wind-eroded limestone, with little or no sand or soil upon its surface. Its general character may be best imagined by supposing that a short choppy sea has become suddenly solidified. It is in general further diversified by wind-eroded rocks and hummocks of various sizes, and by patches of loose sand. A rather disconcerting feature about this rough type of country lies in the fact that in spite of the size and frequency of these rough, rocky hummocks, no shelter is to be obtained behind any of them. The country has been carved by the wind, and irregularities upon the surface have in general been chiseled down to lenticular shaped masses, with their axes placed along the direction of the prevailing wind-flow.

The best desert surface to travel over is that known to the Arab as "Serir," in which the rocky framework of the country is covered with a veneer of sand and rocky fragments:—soil it can scarcely be called, as humus is almost entirely absent. The existence of such a pavement probably depends primarily upon the character of the material forming the underlying rock. If this material tends to weather into spherical form it gradually becomes triturated into sand and dust and is removed by the wind; but if, on the other hand, it weathers into small lenticular or laminated particles, it forms an ideal wind-resisting material.

A portion of our route lay across a region in which the protective paving material was composed of countless thousands of fragments of wind-worn fossil shells, all of approximately the same size and shape—nearly circular and about an inch in diameter—which formed almost a mosaic over a layer of soft loamy soil.

Several well-known and long-used caravan routes traverse the Libyan desert, touching one or more of the oases. Of these routes the Darb el Arbain (the 40 day road) is by far the most important, having constituted the main line of communication between Equatorial Africa, Darfur and Egypt, for a very long period. Its starting point in Darfur is at the town of El Fasher, in Lat. 13°42′ N., Long. 25°20′ E.; and its termination at Assiut on the Nile in Lat. 27°10′ N., Long. 31°10′ E., and so this famous and much-dreaded road passes through nearly 12 degrees of latitude and 6 of longitude.

Entering the Kharga depression at its southern end, it passes in succession the villages of Beris, Bulaq, Gennah, and Kharga, and leaves the basin at its extreme northeastern angle. The crossing of the high plateau between this point and Assiut has always been deemed the most arduous part of the entire journey, for caravans. The surface is very bad; rough "kharafish" surface alternating with loose sand; and the distance between the last available water under the basin rim and the water in the Nile Valley near Assiut is nearly 150 kilometers. Cailliaud, writing in the second decade of the nineteenth century, describes a single caravan which arrived in Assiut over the Darb el Arbain, and contained over 16,000 members, including a large number of slaves;—and remarks upon the wretched condition of both human beings and beasts.

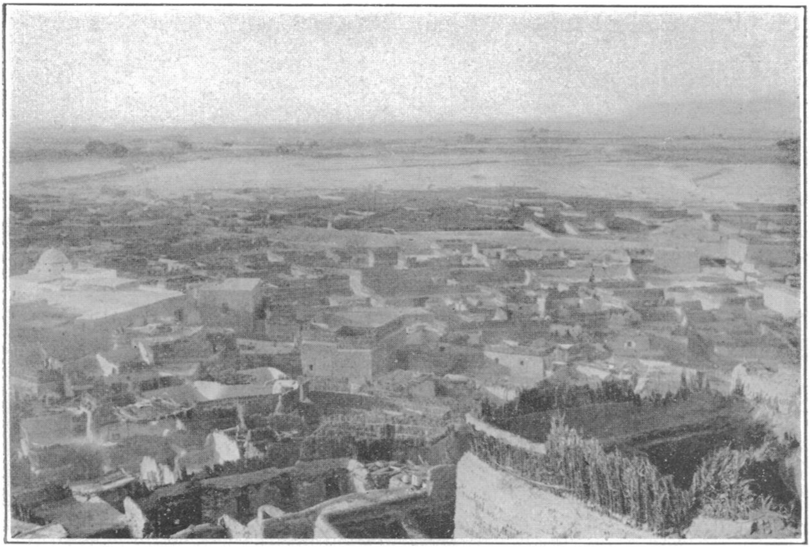

FIG. 4—Panorama from housetops, Müt.

Of other routes, the Darb el Tawil, which leaves the Oasis of Dakhla at its north-east corner and runs to Beni-Adi and Manfalut, in the Nile valley, is perhaps the best known. The Darb el Gubari is one of the main routes between Kharga and Dakhla, and the Darb el Sugag is the most practicable route between Dakhla and Farafra. Several other lines of communication have been in use since very early times, between the various oases and the Nile valley.

The word "oasis," which primarily means an abiding or resting place, is perhaps somewhat of a misnomer as applied to the extensive regions in the Libyan desert, which are generally so termed. The connection, however, lies in the fact that the areas in question are excavated or depressed to a sufficient depth below the general desert level to render the underground water locally accessible, and so make human habitation possible. So formidable, however, are the obstacles to travel and exploration in the Libyan regions in general, that although the oases themselves have been known and inhabited for so long a period, our knowledge of their limits is still far from complete.

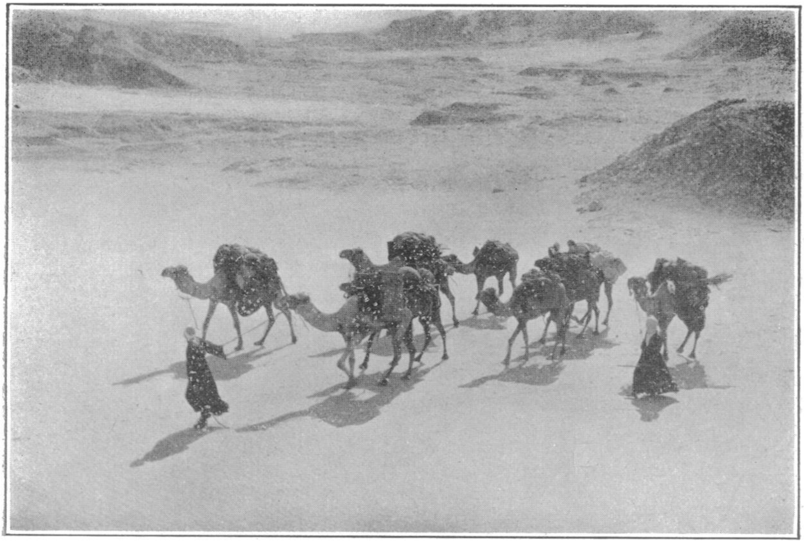

FIG. 5—Ascending the Dakhla rim.

The two inhabited districts of Kharga and Dakhla, which together constitute what is known as the Great Oasis, both lie below the same line of escarpment, although they are fully 120 kilometers apart, and separated by rough and barren country. The oasis of Farafra is bounded to the west and north-west by a bold and well-defined rim, but our knowledge of its other limits is still scanty.

Baharia is a large pit-like depression with a practically unbroken wall or escarpment all around it. It has been commonly referred to as the "Lesser Oasis."

These four, together with the Oasis of Siwa, which is now most commonly and conveniently reached from the end of the Coast-line Railroad which runs west from Alexandria, constitute the most important habitable areas of this immense arid region. One more, the almost unknown Oasis of Kufra, lies far to the west, and is in reality tributary to Tripoli.

The easiest method of reaching the Great Oasis at the present time is by means of a narrow-gauge railroad which starts from the small village of El Qara, situated at the edge of cultivation in the Nile Valley, in Lat. 26°05′ N., Long. 32°03′ E.

The builders of the railroad have taken advantage of a long easy slope which breaks the line of the Libyan escarpment just west of this point, and have then carried the road directly across the plateau towards Kharga, reaching the edge of the depression at a distance of about 150 kilometers from El Qara. This was the route which we followed on our journey to the oases, and arrangements having already been made with the Corporation of Western Egypt, whose headquarters are at Kharga, for men, camels and camp equipment for the desert trip, we were enabled to start without delay.

In addition to ourselves, our party comprised Abu-Salem, our head camel man, and seven other men of various races, ages and degrees of desirability. Our camels were twelve in number—three riding animals, and the rest to carry baggage, water and feed. As we were thoroughly accustomed to desert travel and anxious to keep our outfit as light and portable as possible, we were unwilling to burden our camels with the tents, camp furniture, and many other conveniences pressed upon us by our Kharga friends, and we had no cause during our journey to regret our decision.

The absence of any dragoman or interpreter with our party had also been looked upon as a possible source of trouble and discomfort, as we talked no Arabic, and our men no English, but this difficulty was smoothed away by means of a small Arabic dictionary and our general knowledge of dealing with the outdoor man. Our route was to be first to Kharga Village, thence along the Darb el Gubari to the Oasis of Dakhla and its various villages, then by means of the Darb el Sugag to the little visited Oasis of Farafra, and from thence to

Baharia; returning to the Nile Valley at or about Minia, approximately along the route followed by Capt. Lyons in 1894, on his return journey from the Baharia Oasis.

El Kharga, which is the principal town of the Kharga Oasis, is a rather uninteresting mud-built town, with a population of something over 4,000. There are two small mosques with mud minarets standing out from the general level of the other buildings. The houses are irregular and in general small, and the streets are extremely crooked, narrow, and for the most part covered over either by the upper stories of the houses, or by earth roofs, so as to resemble tortuous tunnels.

The sand has encroached somewhat upon the east side of the town, and most of the cultivated fields and palm groves lie to the west. A number of wells furnish the water necessary for cultivation and for the domestic needs of the villagers.

A short distance north of Kharga is situated the Temple of Hibis, which was built by the Persian kings some 400 or 500 years before the Christian era, and is still in a very fair state of preservation. Several other interesting archæological remains are also to be found in the vicinity, most of which have frequently been described.

Our final watering, before entering upon the Darb El Gubari, was at Bir Mansura, which is a good well some four kilometers north of Kharga. The word Bir means a new well, or rather it is used to designate a well which has been sunk within the actual knowledge of the living generation. For ancient well the term used is Ain. Bir Mansura, therefore, signifies that the well of Mansura has been bored in modern times, and as a matter of fact it was still unfinished in 1898, when the Government Survey party was in the oasis.

Soon after our swing towards the West from Bir Mansura, a belt of soft sand was crossed, a few kilometers in width, and we then entered upon a long succession of open flats, with intervening stretches of low, broken hills and isolated buttes, which lasted until we were well within the confines of the Dakhla Oasis.

The long line of escarpment could sometimes be seen far to the north, and long clear vistas towards the south and southwest could also sometimes be obtained. The country was almost wholly devoid of life, either animal or vegetable, and in fact we traveled for a distance of nearly sixty kilometers without seeing a single plant of any description. The wind-eroded buttes and mounds, the sculptured surfaces of rock and soil, and the occasional sand dune or patch of wind-drifted sand, all bore testimony to the potency of the wind in forming the topography of this desolate land.

Upon the fourth day out from Bir Mansura, our route turned towards the north, and a small well, with two stunted acacia trees growing close beside it, was soon reached. Other evidences of human occupation followed, and we soon saw one of the groups of tombs belonging to the village of Tenida.

The zone of the dead is, in general, the first sign that one is approaching a village, and oftentimes the more pretentious tombs are built in commanding positions and can be seen for long distances. Graves are sometimes surrounded by low walls of sun-dried mud, which are ornamented by inserted fragments of stone and colored with whitewash or red ochre.

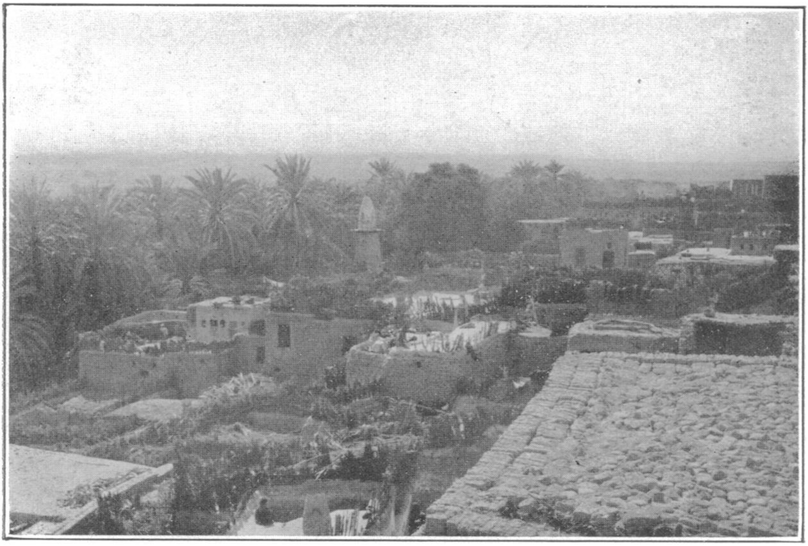

FIG. 6—Rashida from a housetop.

The village of Tenida is situated, as are most of the other oasis villages, upon and surrounding a small hill. It is the most easterly of the Dakhla group of settlements, and has, no doubt, at all times been liable to raids from marauding parties of the desert nomads. It is surrounded by a wall, which is pierced by openings, fitted with large heavy gates. Hoskins, who visited the place in 1837, reports that it was at that time deserted, owing to its unprotected state, and distance from the other villages. There are two wells within the walls, and a number among the surrounding fields and groves, but the region as a whole does not look prosperous or fertile. We stayed for half a day at Tenida, watering and resting our camels and attempting unsuccessfully to obtain eggs, poultry, or fresh meat for ourselves and our men.

Upon leaving Tenida, our next objective point was the town of Müt, which is the administrative headquarters of the Oasis of Dakhla. The distance from Tenida to Müt is about 38 kilometers, and the road connecting the two places passes the two small villages of Smint and Masara, with their small patches of cultivated land.

The town of Müt contains some 1,500 inhabitants and is built in the usual manner, upon a small rough hill. It is surrounded by a rather badly built mud wall, which we were told had been constructed by forced labor, under the direction of the Mudir, during the time of the Dervish raids. As a protective measure, however, it would not rank very high. There are two very good wells within the town, and at one of these a saquia is steadily at work raising water. This is rather an unusual feature in one of these desert villages, and indicates a larger amount of energy and enterprise than is common.

About 2 kilometers to the southwest of Müt are the large and most interesting ruins of what has once been a walled town. The place is evidently very ancient, and the unmistakable brick walls and foundations of the Roman architects come very far up in the series of remains which have gradually accumulated.

A large pit-like depression occupies the center area of the ruins, and a tunnel has been driven from this to the lower ground outside the walls. A stele which was brought from this ruin by Capt. Lyons recorded the very complete details of a long lawsuit over a water-right under one of the Egyptian dynasties, and a full examination and excavation of the place would no doubt reveal many interesting facts concerning the earlier occupancy of the oasis. The cultivated fields extend for only a few kilometers to the west of Müt, and then the sand begins. It looks very forbidding and impossible, and but little is known as to its distribution or extent. Several attempts have been made to penetrate this region, but with little success.

Capt. Lyons passed along the eastern edge of the dunes on his journey from Müt towards Selima in 1893-94, but this route gradually bears away from the sand, and so he was unable to observe its southerly extension. Mr. W. J. Harding King has recently traveled for a considerable distance towards the southwest, however, and reports the country in that direction as more easy of access than had been anticipated.*

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* *Geog. Jour.* Vol. 39, 1912, No. 2, pp. 133-137.

We stayed for nearly two days at Müt, and then began the long northward leg of our journey. Our first stop was at Rashida, and we found this to be by far the most attractive and prosperous-looking of all the villages we saw. It stands, as is common, upon a hill, and is surrounded by very fertile looking palm groves and walled gardens, in which oranges, lemons, bananas and other fruit abound. The village itself contains two small flour-mills, worked by oxen; a mosque, a school, and a number of neat-looking houses. We were taken to the flat roof of one of these houses by a head-man of the place and got a splendid bird's-eye view of the groves, wells and cultivated land.

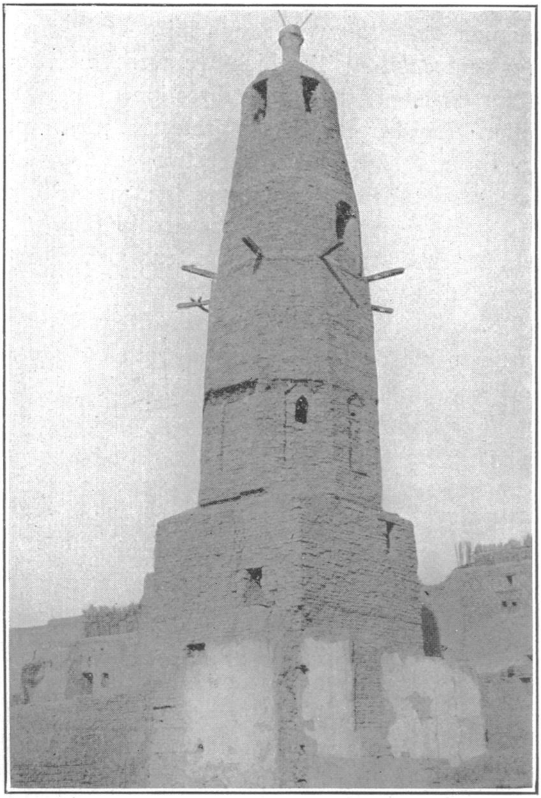

FIG. 7—Mosque minaret at Qasr Dakhl.

The next village we passed was Budkulu, which seemed to be a perfect antithesis to Rashida, dirty, squalid and poverty stricken. A few hours more brought us to Qasr Dakhl, which is the largest and most interesting town in the Dakhla basin. It lies almost at the foot of the northern rim, and is surrounded in the usual manner by a strong and formidable-looking wall, which is pierced by several gateways. The streets of the place are almost as dark and devious as are those of Kharga, and are skillfully protected in many places by heavy doors or gates, and commanded at other points by loopholes in the upper walls of the houses. A marauding enemy would have a particularly strenuous time of it in Qasr Dakhl if the fighting ability of the inhabitants is at all commensurate with their proficiency in military engineering. The town contains between 3,000 and 4,000 people, three good-sized mosques with prominent minarets, and two good wells. We were escorted about the place by some of the head men, and shown several of the leading local industries,—mat making, flour milling and shoe and pottery making. Of these several activities the pottery manufacture is the most important, a very good quality of clay being found in the vicinity. The potter's shed, in the establishment we inspected, contained six wheels, and the quality of the output was excellent. Several kilns were in use for the burning, and bundles of dried casuarina* were used as fuel.

The Darb el Sugag, which we were to follow from Qasr Dakhl to Farafra, climbs the escarpment within a few miles, and the outlook as one approaches the foot of this formidable barrier with a train of heavily loaded camels, is not at all encouraging. The caravan route winds in among rough hills and terraces, and the height of the wall ahead seems steadily to increase. At last the way to the top becomes visible,—a long slope of wind-drifted sand which spreads down fanwise from the mouth of a gorge far above. The camels are obliged to tack up this sand slope in long, sinuous curves, and many and weird are the words of encouragement or vituperation hurled at them by their puffing drivers.

At last, however, the top is gained, and a look back over the immense oasis almost repays one for the climb. The rim through which the way has just been won, stretches away in mysterious lines east and west, and the basin itself is only limited by the blue of the infinite toward the south. Here and there one can see the faint dabs of green-grey which mean palm groves, the grey-brown knobs which mean villages, the yellowish-brown patches of the cultivated lands, or the white speck of a tomb. But in the main the picture is just one of the desert itself, with its sands and sun-browned rocks; and one realizes how slight a mark man has yet been able to make upon this arid land in spite of his 4,000 years of effort. The escarpment is about 300 meters in height, and having gained the top we found ourselves among the roughest description of kharafish surface, with intervening pockets and patches of loose sand.

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* So called from the modern Latin name of the casowary, its branches bearing a resemblance to the feathers of that bird.

To add to our discomfort the weather was becoming very bad, a cold wind from the N.N.W. was gradually increasing in force until it attained the velocity of a gale, and the drifting and almost blinding sand was cutting our faces even as we sat upon our camels. At last our guide gave it up and confessed himself beaten, and so we put down our camels in the most sheltered spot we could find amid the howling desolation, and made our camp. The succeeding night was the most unpleasant one we experienced while in the desert. The temperature became quite low before morning (21°F.), and the wind never ceased.

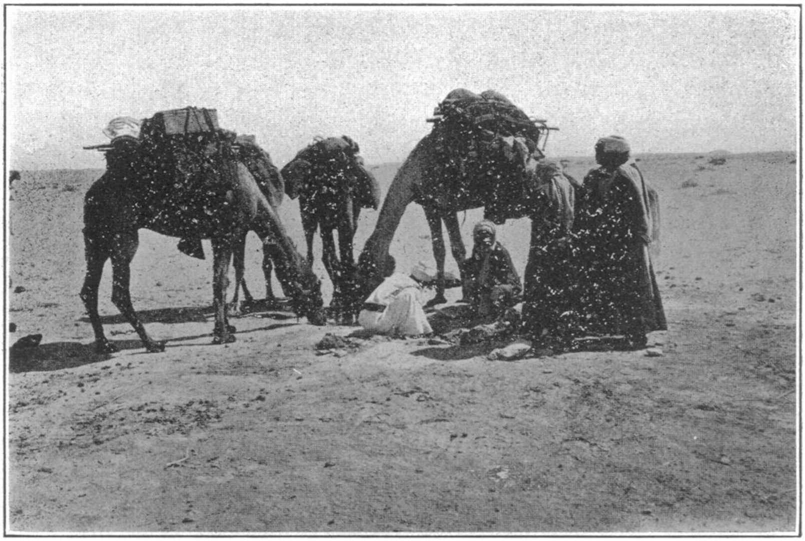

FIG. 8—Camels drinking at Bir Dikker.

It was very bad and uncomfortable for the camel boys with their scanty clothing and covering. They lay huddled together in such shelter as they could find, under the lee of their camels, and followed the desert dweller's universal practice of wrapping the major part of their covering about their heads.

Soon after our start in the morning Abu Salem found what he had been looking for the evening before:—the entrance to one of the "sugags," or passages, between the sand hills, to which reference has been made above. Travel along these sugags is wonderfully easy.

The surface of the ground is soft and even, and the large padded feet of the camel give one the sensation of riding over firm, springy turf.

Occasional small patches of sand are met with, but the ground is for the most part clear .

Having once entered the sugags, we passed through them with only one intermission in crossing a sand field, until the south end of the Oasis of Farafra was reached, at Bir Dikker. We made the very interesting discovery of numerous fragments of ostrich egg-shell among the sand of the dunes. The ostrich can not have inhabited this region for a long time, but the egg-shell seems to be fairly common. Bir Dikker is a typical desert well, and when we arrived there it was carefully covered over with a flat stone and the joints round the edges were sealed with mud. A small basin close at hand, which has been scooped out in the sand and lined and puddled with mud, is used to water camels. A clump of stunted palms, together with the converging desert trails, serves to indicate the position of the well. The water is fair but not very plentiful.

The Oasis of Farafra, in which we had now arrived, is the least known of any of the Inner Oases. It has been visited by but few Europeans, and is markedly different from the other oases, in the character of its inhabitants. The town of Farafra is located, as usual, on a small hill, but its main feature is a large, fort-like community house which occupies the larger part of the place. The inhabitants are grave, dignified and courteous, but quite unapproachable, and very different in manner from the people of the other towns we visited. They belong chiefly to the strict Senussi sect of Mohammedans, and there is a Senussi monastery a little distance outside the village walls.

A site for our camp was allotted to us in an open sandy space between the village and its well, and most of the population came and squatted down in a respectful and attentive row to watch proceedings. Their curiosity once satisfied, however, they left us pretty well alone, and about all we saw of them afterwards was the dim and shadowy silhouette of the women, as they made their early morning trips across the sand to the well for the day's supply of water.

Our first call upon arriving at the village had, of course, been upon the local Omdeh and we were received in a low, dark chamber, around the walls of which were arranged a number of guns, ancient in pattern but evidently still in service. We sat upon the mats with several of the local sheikhs and were regaled with coffee and some wonderful dates, but although Abu Salem made gallant effort to keep up conversation with his only two English words, "Very good," and repeated them with an affirmative, declamatory or interrogative inflexion, again and again, and we used our scant score of Arabic words in the same comprehensive fashion, the conversation soon languished and the interview terminated. We stayed at Farafra two days, but were never invited to inspect either town or gardens, and so saw rather less of this most interesting place than we could have wished.

The village watering-place is a large "ain," half a mile to the south. It is a pool or pond some 75 feet in diameter, and the bubbling up of gas from the well can be seen about in the center. The water is used in all the different ways which the needs of the inhabitants suggest—for drinking, stock watering, laundry purposes, bathing, soaking goat skins, and sky-larking of the children, and then the small residue is used for irrigation. Several of these operations are carried on in the pool itself, and so the general sanitary condition of the water may be imagined, but not described. A small clam-like bivalve lives in large numbers in the warmish water, and dies, or is thrown out upon the bank to add to the general odor. As this well was the only possible source of supply for our use between Farafra and Baharia, we dosed our water rather liberally with potassium permanganate.

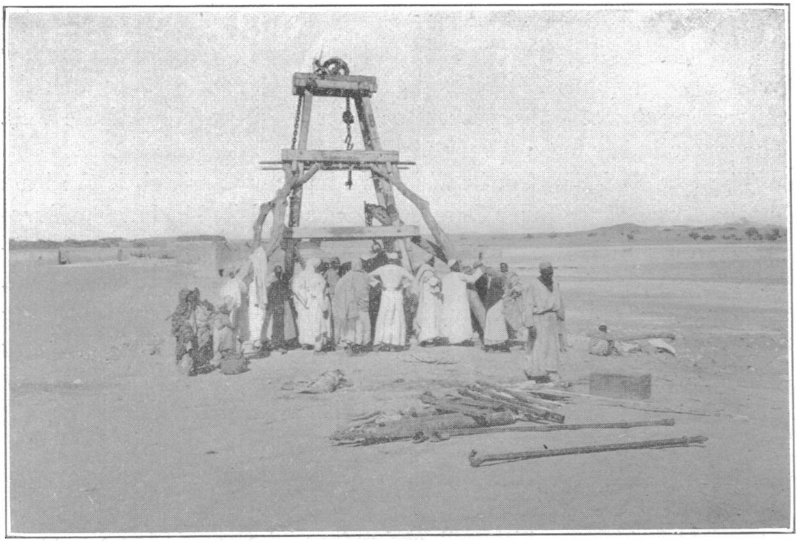

FIG. 9--Well boring at Farafra.

The caravan road, after leaving Farafra village, crosses the floor of the basin for nearly forty kilometers, to a small well known as

Wadi Abu Hessn, where a small quantity of rather indifferent water may be obtained. The country about this well is very typical of the region—thousands of small wind-eroded chalk mounds, from the size of a barrel to that of a house, sometimes hemispherical, but frequently looking somewhat like an inverted bottle. Sir Archibald Edmonstone, writing in 1822, quotes Belzoni to the effect that hillocks of this type, which are very common near the Baharia Oasis, are doubtless the tombs of the army of Cambyses!; the tradition being that Cambyses, who was one of the Persian rulers of Egypt, in the XXVIIth dynasty, sent an army of 50,000 men to subdue the Oasis of Jupiter Ammon, and that they were lost in the desert and never heard of again.

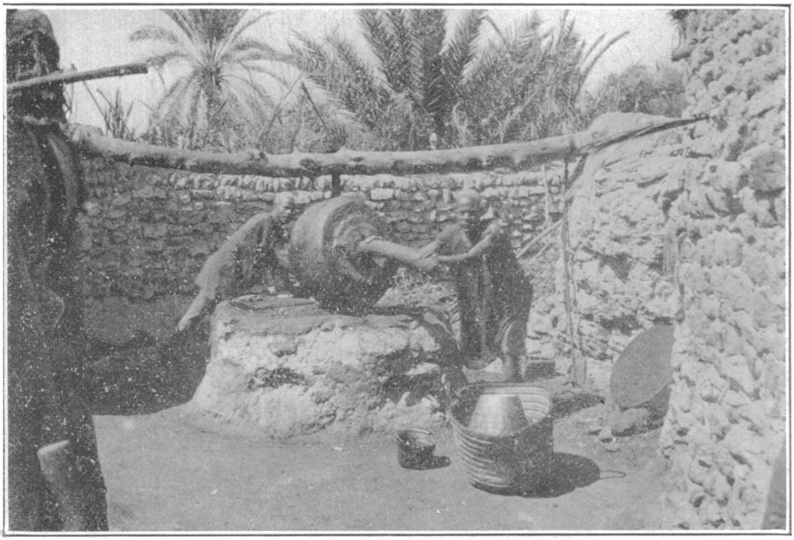

FIG. 10—Olive-oil mill at Bawitte.

We entered the Oasis of Baharia at its extreme southwest angle, and had a splendid view of the basin from the edge of the rim. This rim is comparable in height and steepness with the one up which we climbed after leaving Dakhla, and its ascent must be nearly as difficult for camel trains traveling south. The floor of the oasis, as seen from above, looks nearly level and unobstructed for several miles, with small hills and ridges showing up further on. A few stunted trees or bushes can also be seen here and there. The first signs of human habitation which we saw in the basin were at Ain El Heuss, which is a small, wall-protected settlement, with a few palms, and patches of cultivated ground around it.

There are some very striking examples hereabouts, of the subterranean aqueducts of the Romans. The outward and visible signs of one of these aqueducts will be a line of small irregularities upon the surface of the ground, some twenty or thirty yards apart. These are the traces of the manholes, or spoil-shafts, which the tunnel drivers sunk and utilized for sending up the debris from the headings.

Often the tunnels are now in disuse, and the manhole shafts full of drifted sand, but here and there a line of openings will be seen which have been kept clear of sand by the people of to-day, and upon looking down there one can see the tiny stream of water at the bottom, which the Roman engineers worked so hard to gain. Some of the tunnels are several kilometers in length and in some places the heading is at least 100 feet underground. Beadnell has given a graphic description in "An Egyptian Oasis" of an exploration of one of these remarkable aqueducts.*

The chief settlements in the Baharia basin are the two dual towns of Qasr Baharia-Bawitte and Zubbo-Mandisha. These are all situated near the northern end of the depression, where the water is most abundant. Bawitte was our objective point and was reached the next day after passing El Heuss. We were first made aware of our nearness to the settlement by the sight of a party of grave-robbers at work and a closer acquaintanceship with local conditions revealed the fact that this was indeed one of the major local industries.

The towns of Bawitte-Qasr Dakhl are pretty well surrounded by vast burying-grounds and necropoli, in which the accumulated bones of the last 4,000 years have been laid away, and the gentle Baharian digs open and pilfers these graves of such poor little trinkets of personal adornment as he can find, throwing out odd fragments of humanity with the greatest carelessness. So much so, that the refuse heaps around the doors of many of the village houses, and over which the village children play, are full of such bones and morsels of human clay. The profession seems to be an open one—quite free and untrammeled by any regulations, local or otherwise—but Bawitte would be much more attractive if they would at least clear up the bones.

The conditions of water supply are entirely different here from those in the other oases we visited, inasmuch as the larger part comes from natural springs and outlets and flows in part through natural water courses after reaching the surface. A zone of water bearing strata crops out upon each side of the twin towns—north and south—and the palm groves along the northern side are both good and abundant.

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* An Egyptian Oasis, H. J. Llewellyn Beadnell, London, 1909, page 179, *et seq.*

Bawitte supports an intermittent sort of outdoor bazaar, in a large open space near the mosque. Our needs were confined to sheep, turkeys, bread and fruit, all of which we obtained of excellent quality.

The drifting sand is encroaching very seriously upon some of the palm groves to the north and northwest of Qasr Baharia, and also bids fair to choke some of the wells in this locality, but on the whole the district is fairly free from sand, and in spite of the general untidiness and air of desolation due to the operations of the grave-robbers in so many directions, it looks prosperous and fertile. We were shown through some very well cultivated gardens, and also inspected some establishments for expressing and preparing olive-oil, manufacturing camel-saddles, and making mats. There are numerous early Egyptian and Roman remains hereabouts, in addition to the extensive regions of tombs, and it appears probable that to the Romans at least it was a very important place.

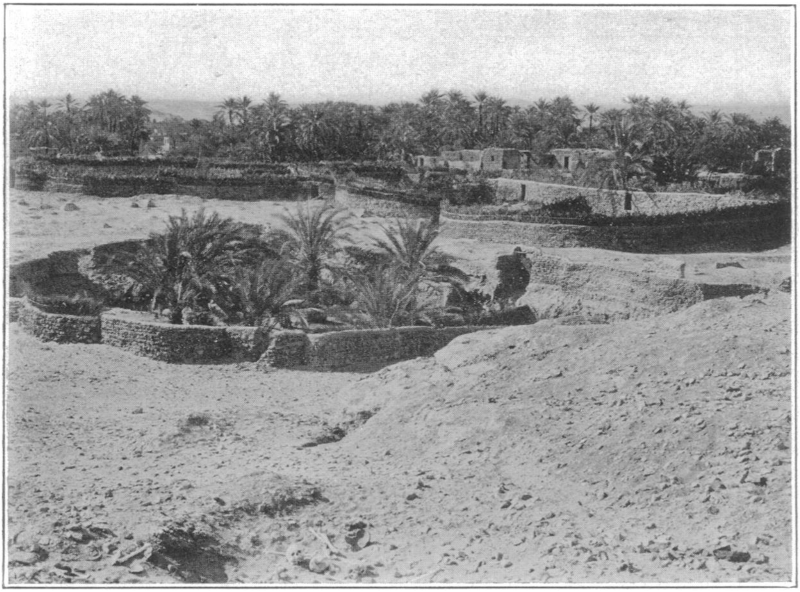

Fig. 11—Walled gardens at Bawitte, showing human bones from rifled graves. Photo by D. T. MacDougal.

Upon our departure from our camp near Bawitte, we passed near to the villages of Zubbo and Mandisha, but did not visit them. Our last halt in the basin was at the little spring of Ain Gelid, which lies near to the foot of the wall at the N. E. end of the basin.

Several of the caravan routes between Baharia and various terminal points in the Nile Valley leave the basin near this point, and Ain Gelid is the usual last watering-place touched at before crossing the desert by these various roads. The ascent of the rim is in this case comparatively easy, being up a long, loamy slope. Once on top, however, the usual kharafish is encountered for several miles, but the surface soon improves again and is fairly good until the remarkable line of sand hills known as the Abu Moharik is approached. A stretch of kharafish is crossed near to the western edge of the sand, which is chiseled out of a particularly hard limestone. The upstanding edges and points upon the surface are very acute, and the driving sand has polished it all, until it looks and glistens in the sunshine like a surface of rough ice.

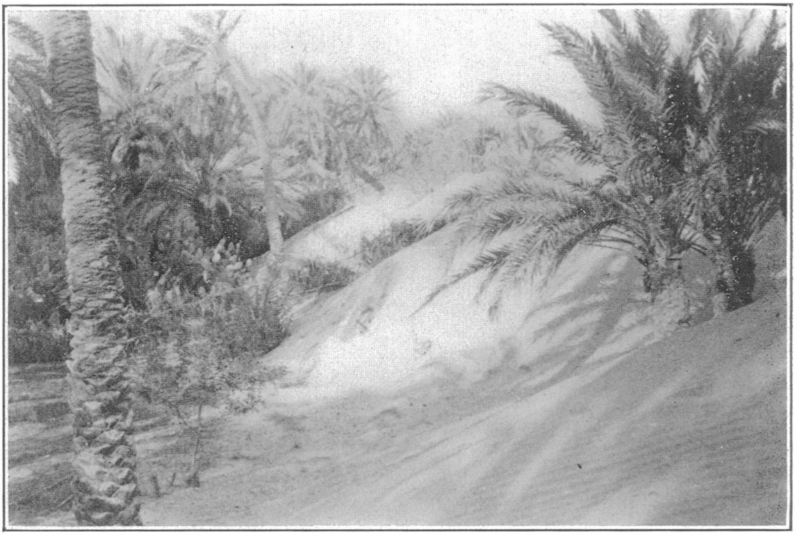

Fig. 12—Sand encroachment at Qasr Baharia.

The Abu Moharik hills are one of the most noteworthy of the Libyan sand ribbons as far as is yet known. They have never yet been traced over the desert from end to end, but different explorers and observers have crossed them at various points, and so their main features are known. The belt is reported as starting somewhere near the tiny Oasis of Moghara, in Lat. 30°12′ N., Long. 29°0′ E., and persisting in a practically unbroken line down to the extreme southern end of the Kharga Oasis in Lat. 24° or thereabouts. Its further possible extension towards the south is as yet unknown, but the distance between the two above mentioned points is approximately 700 kilometers. This was in reality the same line of sand we crossed soon after leaving Kharga. The average width of this sand belt is probably not over 5 kilometers.

The crossing of Abu Moharik was the only serious obstacle we encountered on our journey between Baharia and the Nile, most of the surface beyond it being of the "serir" type—deadly monotonous, but easy and pleasant to travel over. The only incident worthy of note which we encountered by the way was a glimpse at the operation of salt mining, as carried on by a party of Nile Valley men. The salt seems to occur in the form of large irregular masses of crystals, distributed unevenly throughout the ground. These masses they search for and dig out when found. An area of some thousands of acres has been exploited in this manner, and somewhat resembles a prairie-dog town.

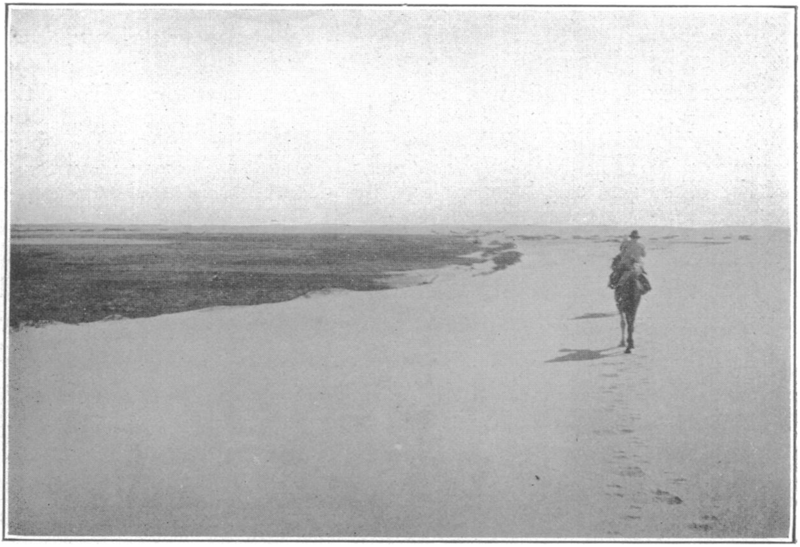

FIG. 13—Dividing line between the desert and fertile ground; Nile valley, west of Minia.

The spirits of our camel boys had been steadily rising, as the Nile Valley, and the end of the journey, were approached, and singing, horse-play, and skylarking were very much in order. At last, from the shoulder of a small hill we saw it—the narrow grey-green line in the far distance, which represented the entire width, although but a small portion of the length, of the wealth of Egypt. It does not look very imposing as viewed from the hinterland of the desert, and the line of division, when one reaches it, between desert and vegetation, is as clear-cut as though made with a knife. We realized more keenly than before how formidable the desert must have seemed to the first men who essayed to cut loose from the fields and flesh-pots of Egypt, to cross it and discover its secrets.

Our "land-fall" was made near the village of Samalut and we then had to turn up the valley some twenty-five kilometers, to reach the town of Minia, which was to be the end of our camel journey. Our last camp was made just outside the wall of some nameless little Nile village, dirty, unsanitary and uninviting, and disturbed by the barking of seemingly countless thousands of dogs.

There are few roads worthy of the name among the fields of the valley. Land is too valuable to be used for such a purpose as road building. Communication is therefore perforce restricted to the tops of the dikes and canal banks, and the desert-bred camel sees many strange and fearsome sights upon either hand to upset his nerves and temper, as he walks upon the tops of these ridges.

Our animals, however, were encouraged, guided and exhorted along until at last Minia was reached and the journey ended. We had spent twenty-four days in the desert between Khargah and Minia, and had covered a distance of something more than 800 kilometers. We had fortunately experienced no serious mishap, and but slight discomfort, and our relations with our canal men (and camels) had been of the best.

It had interested us to note the points of difference between this new type of desert man and the Southwestern Indian, with whom we were familiar. The Bedouin, as we observed him, has a distinctly larger angle of possible directional error than has the Indian, or, in other words, his sense of direction is not so keen. He may vary, in either estimation or actual travel, some 5 to 10 degrees upon either side of a true course. His method of steering seems to be largely observational. He goes simply from one known point to another and of course, is also able to steer to some extent by the stars.

We found that he quickly learned and understood the kind of ground map which one so often uses in geographical conferences with Indians. He would, however, let pass without correction intentional errors in orientation or direction of given points, in a way few Indians would have done. We acquired much useful local topographical information, nevertheless, in this way.

Concerning the general results of our journey and observations, from a scientific point of view, it is as yet a little early to speak, but we at least obtained some extremely valuable comparisons between the Libyan desert and other arid regions with which we are familiar, as well as a most interesting insight into some of the conditions which are peculiar to this region alone.

STUDIES ON CLIMATE AND CROPS

4. CORN CROPS IN THE UNITED STATES

BY

HENRYK ARCTOWSKI

The following figures, expressing in bushels the corn crop for the year 1906,* show plainly how much more important the culture of maize is in the United States than in any other country:

United States	2,927,416,000
Europe	609,614,000
South America	198,988,000
Africa	37,889,000
Australia	8,608,000

It is difficult to realize the quantity of grain 2,927,416,000 bushels represents.

C. P. Hartley writes† that: "If the corn crop of the United States for 1906 had been placed in wagons, fifty bushels per load, and allowing twenty feet of space for each wagon and team, the train of corn would have reached nine times around the world at the equator."

A verification of this statement, prompted by curiosity, gave me 8.8 times around the equator.

Another quotation and we will have an idea of the commercial value of the maize crop harvested in the United States. The Hon. James Wilson, Secretary of Agriculture, in his report for 1909 says:

> "The most striking fact in the world's agriculture is the value of the corn crop of 1909 in this country. It is about $1,720,000,000. It nearly equals the value of the clothing and personal adornment of 76,000,000 people, according to the census of 1910. The gold and silver coin and bullion of the United States are not of greater value. This corn came up from the soil and out from the air in 120 days—$14,000,000 a day for one crop, nearly enough for two Dreadnoughts daily, for peace or war."‡

The following diagram (Fig. 1) shows the average yield of corn per acre for the years 1891 to 1909. We see that in 1901 there

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* Yearbook of the Department of Agriculture for 1908, p. 597. Washington, 1909.
† Cyclopedia of American Agriculture, Edited by L. H. Baily. v. 2, p. 403. New York, 1907.
‡ Annual Report of the Dept. of Agric. for the year ended June 30, 1909. p. 10. Washington, 1910.